Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands	)	WT Docket No. 04-356
	)	
Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands	)	WT Docket No. 02-353

Comments of Powerwave Technologies, Inc.

Powerwave Technologies, Inc. ("Powerwave"), by its counsel, hereby submits these comments in the above-captioned proceeding ("Service rules"). Powerwave is a leading supplier of radio frequency power amplifiers in both the North American and European markets. Powerwave designs, manufactures and markets single and multi-carrier ultra-linear power amplifiers for a variety of radio services and transmission protocols. The company's products are key components in wireless communications networks, including the cellular and Personal Communications Services, and for the wireless local loop market. Powerwave has also developed RF power amplifiers for third generation transmission protocols that will be used with Advanced Wireless Services ("AWS").

Powerwave submits these comments with respect to only one of the AWS technical proposals. Specifically, Powerwave objects to the proposal to limit power for fixed and base stations transmitting in the 1995-2000 MHz and 2175-2180 MHz bands to a peak effective isotropic radiated power (EIRP) of 1640 watts and a peak output power

of 100 watts.[1] First, it is clearly the Commission's intent for AWS frequencies to be used seamlessly in conjunction with PCS frequencies, making the underlying spectrum effectively transparent to broadband users; however, the proposed rules will make seamless operations very difficult to achieve by proposing base station power limits for AWS that are more restrictive than the existing limits for PCS. Second, the Commission once again neglects to take note of the fact that the Section PCS base station power limits are currently under review in the Commission's 2002 Biennial Review and are quite likely to be changed.[2] Thus, any attempt to harmonize AWS base station technical specifications with those of the PCS service must take into account the Commission's pending Biennial Review proceeding. By not doing so, the AWS rulemaking is being compromised, *ab initio*, as base station manufacturers face further inconsistent and out-of-date power limits.

The Proposed Power Limitations for AWS Base Stations Are Different From Existing Power Limitations for PCS Base Stations

Section 24.232(a) limits PCS base stations to 1640 watts EIRP but provides that "[i]n no case may the peak output power of a base station transmitter exceed 100 watts.". Tracking this provision, proposed Section 27.50(e)(1) also limits AWS base stations to

[1] *See* Section 27.50 of the proposed Service rules.

[2] Biennial Regulatory Review – Amendment of Parts 1, 22, 24, 27, and 90 to Streamline and Harmonize Various Rules Affecting Wireless Radio Services, *Notice of Proposed Rulemaking*, FCC 03-334, adopted December 29, 2003. In WT Docket No. 02-353, *In the Matter of Service rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands*, the Commission, also apparently not cognizant of its proposals in the Biennial Regulatory Review proceeding proposed the same, out-of-date and impractical, power limitations. On March 8, 2004, Powerwave filed a Petition for Reconsideration reminding the Commission of its error and requesting that the imposition of power limitations be held in abeyance pending the decision in the Biennial Review. By proposing the same power limitation in the present proceeding, the Commission has apparently acted without regard to either the Biennial Review or earlier AWS proceedings.

1640 watts EIRP and a 100 watt peak output power limit, but applies the latter limitation not to a "base station transmitter," but to the the entire base station. Bearing in mind that AWS base stations, like PCS base stations, will be comprised of multiple transmitters it is clear that the proposed AWS peak power limit is much more restrictive than PCS. Thus, for example, a PCS base station with ten transmitters is allowed up to 100 watts peak power for each transmitter, whereas a AWS base station with ten transmitters would be limited to 100 watts for the combined array. Not only would this disadvantage AWS base stations as compared to PCS but also would defeat the seamless operation between the two services that the Commission seeks.

If Section 27.50(e)(1) is adopted as proposed, there would be the anomalous situation where a PCS licensee might not be able to provide AWS services over its PCS facilities unless it built a new system with more cell sites. As the Commission correctly noted in discussing comments from AT&T in the companion proceeding adopting service rules in the 1.7 and 2.1 GHz AWS bands, "…if we were to adopt substantially different technical rules for AWS it would force carriers, in areas where both CMRS and AWS spectrum is used, to 'construct and maintain two parallel radio interface networks, including cell sites, towers and antennas, in order to maintain the same level of service coverage and quality'"[3]

At the very least, therefore, the Commission must recognize that Section 27.50(e)(1) should not set a 100 watt power limit on a per base station basis because this will conflict directly with the base station limits proposed in other spectrum. Moreover, because the 2000 Biennial Review proposes further changes to the broadband PCS

[3] *See* Report and Order in Docket No. 02-353, *Service Rules for Advanced Wireless Service in the 1.7 GHZ and 2.1 GHz Bands*, at Para. 254

power limits, the best course for ensuring spectrum harmonization is to hold the AWS base station rules in abeyance until the Commission issues its Report and Order in that proceeding.

The AWS Power Limits Should Track Changes Being Made to the PCS Power Limits

The proposal to change the PCS power limits in the 2000 Biennial Review was initiated by Powerwave over two years ago. As Powerwave explained to the Commission in that proceeding, as the number of PCS subscribers has vastly increased over the years the number of "carriers" (*i.e*. the individual signals that carry information) required to provide the additional voice channels has also increased. Whereas traditionally, each carrier/channel was powered by a single-channel power amplifier the trend in recent years, particularly with GSM carriers, has been for operators to use multi-carrier power amplifiers ("MCPAs").[4]

While the 100 watt per transmitter limit may have made sense when a single amplifier was used for each carrier, the rule today discriminates against MCPA designs. MCPAs combine the low power output of multiple radios, amplify the combined output and feed the amplified output to the base station antenna. A literal reading of the Commission's rules would result in the MCPA being considered one transmitter limited to 100 watts of output power regardless of the number of carriers it is amplifying.[5] Each

[4] Among the various advantages of MCPAs over single carrier amplifiers is that they permit the low power combining of signals which allows for improved cancellation of intermodulation distortion and the elimination of large losses as compared to high power combining designs; improve frequency channel spacing which increases network calling capacity; improve the transfer of final transmit power to the antenna; and permit greater flexibility for mixed-mode capability permitting some operators to transfer from one transmission technology to another (i.e. TDMA to GSM).

[5] As Powerwave has explained, in its 1994 Reconsideration of the PCS rules, the Commission recognized the limitations of specifying power on a per transmitter basis stating, "As regards power levels per

carrier, therefore, would be relegated to only a fraction of 100 watts. In single channel system designs, however, each carrier is amplified up to the 100 watt maximum, combined and then output to the base station antenna. Thus, each carrier can be operated at the full 100 watts. It is this inequity that penalizes the use of MCPAs and prompted Powerwave to seek a waiver from the Commission over two years ago.

On April 4, 2002, the staff of the Wireless Bureau granted a waiver of Section 24.232(a) to permit Powerwave to obtain certification of a 125 watt MCPA. The staff indicated that application of the 100 watt transmitter power limit to MCPAs did not serve the underlying purpose of the rule which was to limit transmitter output power on a "per channel" basis; moreover an additional 25 watts represented only a *de minimis* change from what the rule specifies. The staff then invited Powerwave to seek an amendment of Section 24.232(a) to allow the use of higher power amplifiers. As directed, Powerwave sought such an amendment in the context of the Biennial Review.

Powerwave recommended that the Commission simply eliminate the "belt and suspenders" approach of having both an EIRP and a peak power limit, and retain only the EIRP limit on a per carrier basis as intended in the 1994 Reconsideration. The Commission staff agreed with Powerwave and concluded, "Section 24.232(a) should be modified in order to regulate PCS base station transmissions in a technologically neutral manner."[6] The staff indicated that "the current rule may hinder the development and deployment of technologies (e.g. the multi-carrier amplifiers described by Powerwave)

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transmitter, antenna or antenna element, it was always our intent that the 100 watts per channel and 1640 watts EIRP requirements apply to these individual components and not to the sum of all components at the entire base station provided the maximum EIRP radiated by the base station in any given direction on any given channel does not exceed 1640 watts. [emphasis supplied} See *Third Memorandum Opinion and Order on Reconsideration,* 9 FCC Rcd 6908, 6918 (1994). Unfortunately, this interpretation – that both EIRP and power were to be determined on a per channel (carrier) basis was never formally placed in the rules.

[6] 2002 Biennial Review Staff Report at 9; see also Biennia Review Staff Report Appendix at 67

that combine signals in innovative was, yet do not increase the potential for harmful interference to neighboring systems." The Commission subsequently sought comment on whether to relax the power limitations of Section 24.232(a) by either amending the rule to clarify that the output power of 100 watts applies on a per carrier basis or to eliminate the output power restriction entirely and simply retain the EIRP limitation on a per carrier basis. In the alternative, the Commission asked whether, instead of an EIRP per carrier limit, it might be more desirable to adopt a power limitation based on spectral power density (SPD).

One technology neutral approach proposed by base station manufacturers is to permit both CDMA and GSM systems to transmit at the SPD equivalent of the current 1640 MHz per carrier as many operators do today. Because GSM and CDMA carriers involve different bandwidths,[7] such an approach would yield an SPD for GSM base stations of 8200 watts/MHz EIRP and for CDMA stations of 2050 watts/MHz EIRP. It is noted that in its comments in the Biennial Review, Qualcomm proposed a limit of 5040 watts/MHz EIRP for all PCS technologies. Others, such as Motorola, have suggested two limits, one for carriers over 1 MHz in bandwidth and another for carriers less than 1 MHz. Whatever approach the Commission elects to follow, Powerwave is reasonably certain that Section 24.232(a) will be amended to eliminate the present disparity in treatment between single- and multi-channel amplifiers either by making it clear that the 100 watt peak power limitation applies on a per carrier basis or by eliminating the peak power limitation altogether.[8]

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[7] A GSM carrier is 200 kHz, whereas a CDMA carrier is 1.25 MHz.

[8] There has been uniform agreement from commenters in the Biennial Review rulemaking that the peak power limitation is no longer needed. Widely differing approaches, however, have been suggested with respect to the SPD issue. Powerwave has made it clear that whatever approach is adopted, it's primary

A common approach should apply to AWS as these systems are expected to be designed to share a common architecture with PCS systems and, just as with PCS, market demand will drive base station development of additional carriers. AWS systems therefore, will use MCPAs to handle the increased traffic and it is important that the Commission remove any bias against MCPAs created by the present wording of Section 24.232(a).

Conclusion

For the reasons set forth above, Powerwave requests that the Commission hold the AWS base station power limits in abeyance pending resolution of these matters in the Biennial Review proceeding. Section 27.50(e)(1) can then be conformed to the amendments made to Section 24.232(a) to remove the disparity that exists between single channel amplifiers and MCPAs. Should the Commission ultimately choose to limit power by adopting SPD limits, GSM systems should, for the reasons shown, be permitted the SPD equivalent of 1640 watts EIRP per carrier as they currently use today.

Respectively Submitted,

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concern is that PCS operators continue to be able to transmit with at least a SPD equivalent to their present 1640 watt EIRP per carrier power. [expand what this means]